

Summary of Main Deliberations at the Sixth International Implementation Planning Meeting for the Coordinated Enhanced Observing Period (CEOP) (12-14 March 2007 IN THE USA National Academy OF Sciences (NAS) Building, Washington D.C., USA) (see: <http://www.ceop.net>).

BACKGROUND First

The initial successes of CEOP, up to the end of 2004, had led its Science Steering Committee and Advisory and Oversight Committee to endorse plans for a second phase of CEOP that would have extended to the end of 2010. CEOP Phase 2 was formulated and has been guided by formal Science and Implementation Plans and involves a number of technical and science driven working groups that were reviewed and received direction and oversight from a Science Steering Committee and an Advisory and Oversight Committee. With the demonstrated uniqueness of CEOP Phase 1 and advent of CEOP Phase 2, which was to extend the time period of enhanced observations and enhance the science agenda, it was clear that CEOP would contribute to the scientific objectives of GEWEX and integrated data management activities of WCRP on a longer time period than initially anticipated.

The GEWEX Science Steering Committee (SSG) along with the WCRP Joint Scientific Committee (JSC) had each noted that CEOP was heavily entrained into the activities that have been undertaken by the GEWEX Hydrometeorology Panel (GHP). CEOP has especially taken advantage of the GEWEX Continental-Scale Experiments (CSEs), which have been assisting GEWEX to demonstrate skill in predicting variability in water resources and soil moisture on time scales up to seasonal and annual as an element of WCRP's prediction goals for the climate system.

As a result of this close collaboration and in order to preclude any perceived or real overlap of efforts, GEWEX, in full agreement with the GHP, and with CEOP, has decided to merge GHP and CEOP to form a new entity, designated the "Coordinated Energy and water cycle Observations Project (CEOP)". This formal merger is meant to enhance the efforts of both GHP and CEOP and will not lose sight of any of the GHP strategic goals or any of the ongoing GHP science work since the same scientists and more are already working on closely related projects and goals in the former CEOP. It does mean, however, a refocusing of the former GEWEX CSE and GHP agendas toward the new Coordinated Energy and water cycle Observations Project (CEOP). This decision has also been supported by the broader WCRP climate research community.

In this context, the main themes of the Sixth CEOP International Implementation Planning Meeting were:

- I. Assessment of the former CEOP Phase 1 accomplishments.
- II. Introduction of the framework of the new GHP/CEOP merged activity, which will consist of the following elements:

Science Initiatives including work based on

- the Regional Hydroclimate Projects (RHPs), which were formerly designated the Continental Scale Experiments (CSEs);
- Cross RHP Studies such as Monsoons, Cold regions, Semi-arid regions, High-altitude, Tropics, etc.;
- Global Projects associated with data climatologies;
- Cross-cutting/enabling sciences such as Analyses and Budget studies, Modeling at all scales, satellite and data assimilation, isotopes, aerosols, extremes, hydrologic applications, etc.; and

Data Infrastructure including data at all scales including sites, river basin, RHP, regional (more than one RHP), and global

- In-situ: NCAR/EOL
- Global Data Centers: GRDC, GPCC, IAEA, GRP, BSRN
- Modeling: MPI
- Satellite and Integration: UT

III. Outline Task Plan for Update/Development of CEOP Implementation/Science Plan

IV. CEOP Contributions to WCRP/GEWEX Goals and Objectives i.e. GEWEX “Roadmap”

PART I - ASSESSMENT OF THE FORMER CEOP PHASE 1 ACCOMPLISHMENTS

Since the Fifth Implementation Planning Meeting (see body of this report), CEOP has made progress in further development of the two sets of unique functional components that have been established during CEOP Phase 1. The presentations at the Sixth Implementation Planning Meeting, therefore, included the status of progress toward further development and application of:

- components to integrate observations based on coordination among field science groups, space agencies, and numerical weather prediction centers in the local, regional and global scales;
- components required to exchange and disseminate observational data and information including data management that encompasses functions such as Quality Assessment/Quality Control, access to data, and archiving of data, data integration and visualization, and information fusion.

The key achievements reported included a substantial increase of the volume of data stored in the respective CEOP archives for the Phase 1 Enhanced Observing Periods EOP-1, EOP-3, EOP-4, i.e. in-situ archive at the National Center for Atmospheric Research (Colorado, USA; <http://www.eol.ucar.edu/projects/ceop/dm/>); model output archive at the Max-Planck Institute (Hamburg, Germany; http://cera-www.dkrz.de/CERA/cera2browser_CEOP/index.html); and the satellite data archive at University of Tokyo, Japan at: http://monsoon.t.u-tokyo.ac.jp/ceop-dc/ceop-dc_top.htm). A major portion of the expected data for CEOP Phase 1 has already been uploaded and is available through the on-line data archives and data integration systems. The amount of data at each center is continually being up dated. Snap shots of the amounts of data have already been presented in the body of this report, but more accurate up to date information can be found at the Web pages referenced in this paragraph.

It was reported at the meeting that significant progress has been made in development of the CEOP Data Integration Services, namely the Distributed Data Integration System (http://jaxa.ceos.org/wtf_ceop/) and the Centralized Data Integration System (http://monsoon.t.u-tokyo.ac.jp/ceop-dc/ceop-dc_top.htm). Both systems are being regularly updated to reflect progress in data submission to CEOP. Moreover, new capabilities have been and are being developed and included on the systems to provide users with a wide range of functions of data retrieval, visualization and analysis and also to allow for compatibility with other relevant data portals.

Significant advances within CEOP of satellite, and ground-based remote sensing and in-situ observations data management and coordination with strong connections to the climate modeling community provided an excellent opportunity for the development of national and a growing number of international programs to assess the impact of aerosols on radiation, clouds and their interaction with the Asian summer monsoon at a CEOP Co-sponsored Workshop on that topic held in Xining Qinghai Province, China from 31 July to 4 August 2006.

During the meeting it was also reported that besides following its normal schedule of regular international conference calls and Newsletter publications, CEOP has also begun a funded CEOP

Analyses Intercomparison Project and had a CEOP IPY proposal accepted in cooperation with the CliC core Project.

PART II - INTRODUCTION OF THE FRAMEWORK OF THE NEW GHP/CEOP MERGED ACTIVITY

It was announced at the meeting that GEWEX, in full agreement with the GEWEX Hydrometeorological Panel (GHP), and with the Coordinated Enhanced Observing Period 'CEOP', had decided to merge GHP and 'CEOP' to form a new entity, designated the "**Coordinated Energy and water cycle Observations Project (CEOP)**". This formal merger was described to be accomplished in order to enhance the efforts of both GHP and 'CEOP' and will not lose sight of any of the GHP strategic goals or any of the ongoing GHP science work since the same scientists and more are already working on closely related projects and goals in 'CEOP'. It does mean, however, a refocusing of the former GEWEX CSE and GHP agendas toward the new **Coordinated Energy and water cycle Observations Project (CEOP)**. The generalized structure in an overview format is shown on Figure 1 of Appendix A. From the GEWEX perspective the specific structure is as shown in the Figure C-1 below.

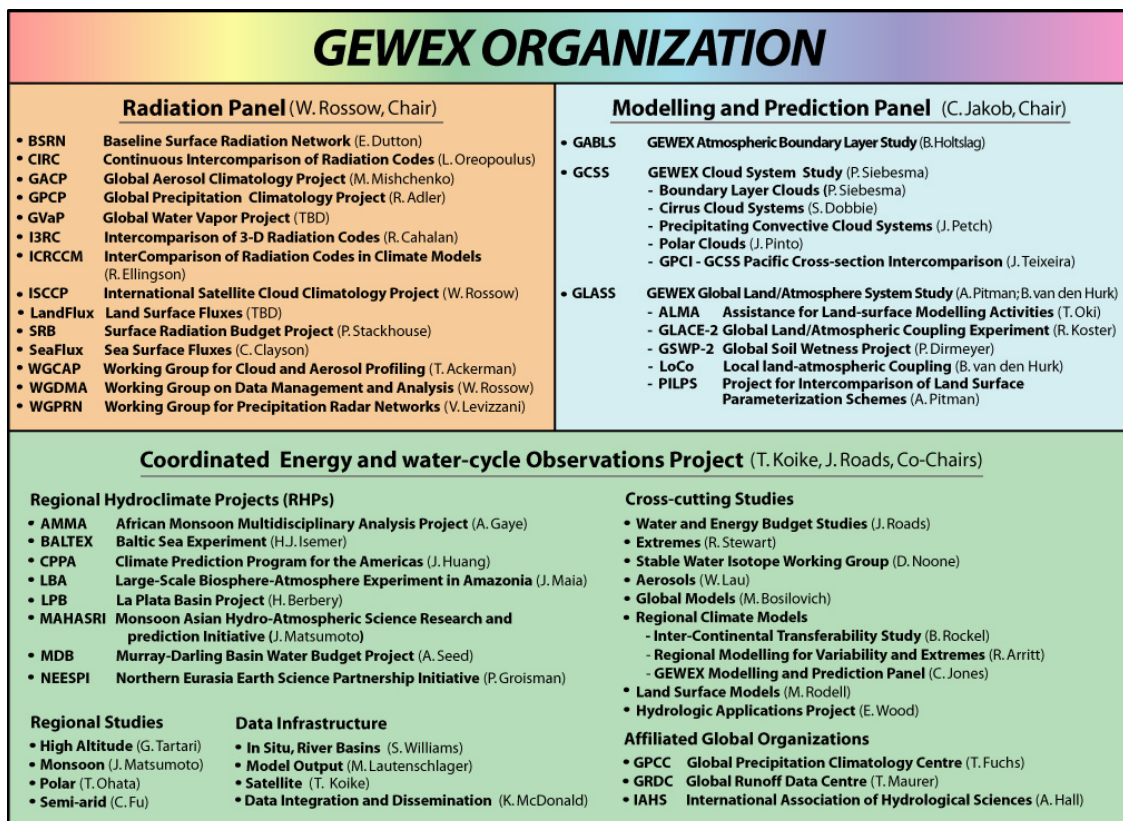


Figure C-1- New CEOP Framework within the GEWEX Panel/Project context

The tone for new directions in the new CEOP framework was established by further outlining of the current baseline and by a review of issues and recommendations that had been made at previous meetings and taken up by the CEOP community. These included:

(i) CEOP will take extra efforts to underwrite its current level of success in development of its in situ model and satellite datasets. In particular it will articulate and implement a clear strategy for finalizing collection of its Phase 1 in-situ and satellite datasets, each of which continues to show numerous gaps. This strategy will also be made functional under the new

CEOP/GHP merged organizational structure, whereby CEOP will continue timely data collection at all reference sites; production of model products at all contributing NWP centers; and exploitation of all relevant operational and experimental satellite instrument data in a coordinated manner.

(ii) In the context of its data collection process the newly constituted CEOP will continue its relationship with data archive Centers at UCAR, MPI and JAXA/UT. CEOP will work to ensure that Funding for these efforts will be maintained and that the centers will work together to ensure the synergy of the three data types is maintained into the future.

(iii) In the future the new CEOP will remove any confusion about its unique contribution to climate research. The questions and dialog about its unique nature has lead to a clearer expression of it being science driven versus science enabling. It is important for scientists to be involved in data related activities to ensure the value of the resultant products to the broader community. CEOP does not, therefore, necessarily have to be about establishing an integrated data system, even though that might be an outcome of the implementation of the unique coordinated data management scheme it has fostered.

(iv) CEOP in its new framework will work to further clarify its function/status in WCRP. Connections with other core projects such as CliC and CLIVAR and oversight by groups such as the JSC/WOAP will result in conclusions about its unique structure and range of interactions among and between multi-disciplinary scientists/groups and various technical and data management experts/centers. Such a new unifying configuration should result in CEOP continuing to be a collaborating Project within WCRP.

(v) CEOP in its new framework will continue to evolve as a relevant aspect of the initial configuration of GEO/GEOSS. The new CEOP will relate to GEO in a positive manner but the specific ways this will be accomplished needs to be fully explored and explicitly explained in the future.

(vi) It is valid and appropriate for CEOP in its new configuration to expand its science scope and from material incorporated into its Implementation/Science Plan the new work on extremes/teleconnections; aerosols and water cycle; watershed hydrology as science issues and the extension/enhancement of data collection and analyses into cold and semi-arid regions is to be part of CEOP's future vision.

(vii) In the context of a clarification of its unique contribution to climate research CEOP will want to revisit its role and position in WCRP to the point of it being established as a special coordinating Project in WCRP.

These concepts/recommendations for future action and direction of the new CEOP lead to further efforts to clarify CEOP within the context of GEWEX, WCRP and the broader IGOS, GEO communities.

As noted CEOP is now led by two Co-Chairs. The CEOP Co-Chairs agreed that the main issue to be addressed in the new CEOP framework is the connection between the science and data components of the Coordinated Enhanced Observing Period and the GEWEX Continental Scale Experiments (CSE's), in the new Coordinated Energy and Water Cycle Observation Project. It was announced at the meeting that the GEWEX SSG approved changing the name of GEWEX CSE to GEWEX **Regional Hydroclimate Projects (RHPs)** as had been recommended in the merger whitepaper provided in Appendix A of this report.

This development led the Co-Chairs to adjust the overall configuration of the new CEOP to give a clearer picture of the interaction between the work that had existed within the GHP CSEs and the various elements of the Coordinated Enhanced Observing Period. The outcome of these deliberations are shown in the two figures C-2 and C-3 below:

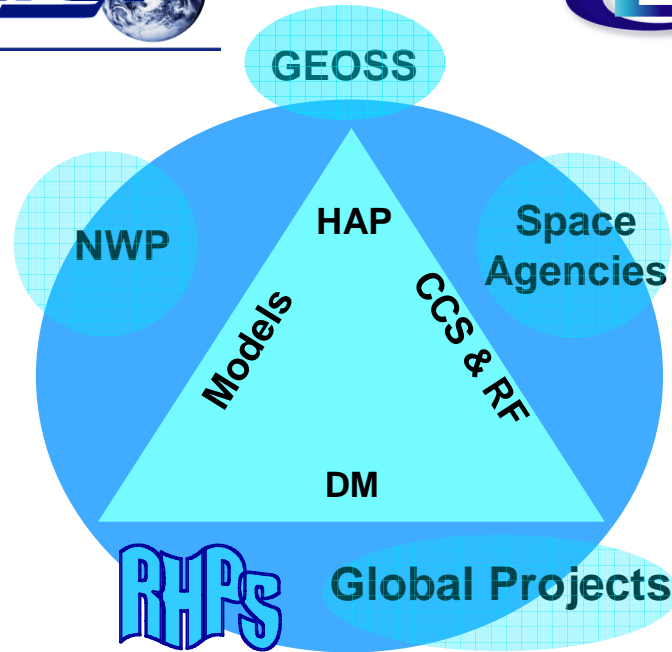


Figure C-2: Overview of new CEOP Framework

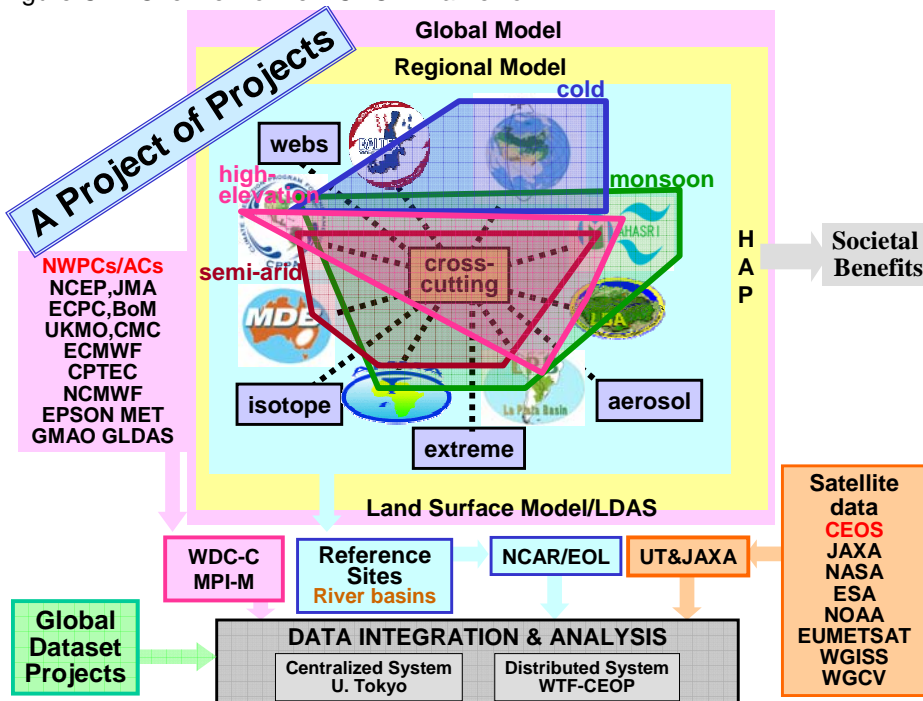


Figure C-3: Schematic Diagram of the New CEOP Framework
 Part IIa Introduction/Configuration of Merged Science and Data Initiatives

The work being undertaken as a precursor to CEOP Phase 2, as presented at the CEOP 2006 International Implementation Planning meeting, and the plan and schedule for the kick-off and implementation of Phase 2 that was scheduled to begin in 2007 emphasized the extension of existing data and observation processes and greater stress on the research and analysis components of the Coordinated Enhanced Observing Period, providing for CEOP to meet its commitments to CEOS/IGOS-P Water Theme, WCRP and GEOSS. With the merger between GHP and the Coordinated Enhanced Observing Period it was agreed at the meeting that it was still necessary for each of the "Phase 2" initiatives to be maintained under the Coordinated Energy and Water Cycle Observation Project so that the Co-Chairs of the new CEOP and the lead persons of each Working Group needed to agree to accept the **action** to advanced that work in 2006-2007 including:

- (i) The emphasis on the diurnal cycle as a unifying scientific theme;
- (ii) Plans to continue with a watershed hydrology component;
- (iii) Contributions towards, examination of some inter-connectivity between land areas;
- (iv) To embark on a Worldwide Integrated Study of Extremes (WISE);
- (v) To undertake a joint initiative with the WCRP Climate and Cryosphere CEOP/ClC project and the International Polar Year (IPY);
- (vi) To exploit CEOP reference sites located in semi-arid regions;
- (vii) To augment and formalize the CEOP international coordination function

The results of the work in these areas up to the time of the meeting was presented by the CEOP Co-Chair Prof Toshio Koike. The Table below updated to the time of the meeting summarizes these accomplishments.

Criteria for measuring CEOP Progress		Technical Requirements, P, I, F (Planned, Initiating, Functioning) Scientific Requirements B, Pr, C (Beginning, Progressing, Completed)	
Data Management	Reference Site Composite Data Archive	F	35 Reference Sites, EOP-1: <i>completed</i> , EOP-3/4: <i>on-going</i> 1 paper in Special Issue.
	Model Output Archive	F	11 centers, 6 papers in Special Issue.
	Satellite Products Archive	F	TMI,PR, SSM/I, GLI, AMSR, AMSR-E, GMS: <i>completed</i> AVHRR, AMSU, AIRS, MODIS, ASAR, MERIS : <i>on-going</i>
	Interoperability Arrangement	F	Workshop on SMeta Data Design and Implementation, GCMD portal, 1 paper in Special Issue.
	Distributed Data Integration System	F	Open in June, 2005, 1 paper in Special Issue.
	Centralized Data Integration System	F	Open in June, 2005, 2 papers in Special Issue.
WESP	Water and Energy Budget	Pr	10 papers in Special Issue.
	Model Output Validation by NWP Centers	Pr	1 Workshops (Irvine)
	GLDAS	Pr	GLDAS Product: 1d, 1/4d, 1km
	GHP/CEOP Model Transferability Study	Pr	
	Model Inter-comparison Study	Pr	
CIMS	Monsoon Intercomparison Study	Pr	3 Workshops and 9 CEOP sessions of symposia and conferences
	Diurnal, Intraseasonal and Seasonal Variability	Pr	2 refereed papers
	Monsoon Process Study by Using Models	Pr	6 papers in Special Issue.
	Impacts of Local & Remote Forcings on Monsoon	B	
Satellite	Algorithm Development and Validation	Pr	Soil moisture, Snow, 2 papers Special Issue
	Satellite Data Assimilation for Land Hydrology	Pr	Soil moisture, Snow, Surface fluxes, 2 papers in Special Issue
Project Management	Establishment of Direct Links and Connections	F	Reference Sites, NWPCS, Space Agencies
	CEOP Meetings	F	Implementation Planning Meeting 5(6), Workshops, Tele-Conf.
	Scientific Conferences	F	AGU:3(4), AOGS:1(2), AMS:1
	Levy Actions/Milestone Documentation and Tracking	F	Working Groups, ICB, Phase 2 IP submitted to SSG and JSC
	Newsletter	F	Twice a Year (1-10)

As the means for unifying these results and to address the need to perpetuate and push this work forward within the merged GHP/CEOP framework breakout groups were convened to

explore the connections and assess the most efficient means for establishment of links between the components of the Coordinated Enhanced Observing Period and the former CSEs.

The Chairs and Correspondents of the Breakout Sessions organized their groups to respond to the following topics:

- (i) Milestones/Results remaining in Phase 1
- (ii) Overall Objectives for new CEOP activities
- (iii) Milestones to be achieved within the following 2–3 years and proposed implementation steps
- (iv) Connections/Joint activities with other Projects, in particular GMPP, GRP and core projects of WCRP

The four groups met in parallel sessions and addressed the above issues in the context of the main components of the new CEOP framework. These elements were identified as follows:

Regional Hydroclimate Projects (H-Y Isemer, C. Fu)
AMMA/BALTEX/CPPA/MAHASRI/MDB/NEESPI/LBA/LPB
COLD/MONSOON/SEMIARID/HIGH-ELEVATION

Crosscutting Studies (R. Stewart)
WEBS/WISE/SWING/AEROSOLS

Models (M. Bosilovich)
Global/Regional/Land/HAP

Data (S. Williams, F. Toussaint)
In situ, (Basins/Model/Satellite/Data Integration), Global Data Centers

Following their deliberations the conveners of the groups presented the outcome of their discussions during a plenary session. The individual presentations are available upon request from the Tokyo International CEOP Office (TICO) through email request to the Office Manager Ms Akiko Goda at: goda@hydra.t.u-tokyo.ac.jp.

However, as a means for providing a level of consistency that could lead to a concise means of expanding the conclusions of the groups into elements for updating the CEOP Implementation/Science Plan the CEOP Co-Chair Prof T. Koike developed an implementation Matrix that he developed by noting each science topic and each data handling item that was mentioned during the discussion sessions where **action or interaction** between or among the working groups within the new CEOP framework was mentioned specifically in the context of “needs” or “requirements” of one group upon another.

This approach enables the subsequently crafted matrix to become a touchstone for identifying where needs exist that are being met and where more work or definition of requirements and explanation of interactions must still be defined.

It was agreed, therefore, that the matrix would serve as the basis for an expansion/update of the existing Coordinated Enhanced Observing Period Implementation/Science Plan. Such an expansion or update would, therefore, result in what would be considered the Implementation/Science Plan of the new CEOP “Project of Projects”.

The matrix is provided in the figure (C-4) below:

CEOP coordination assessment overview

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	
1.AMMA	■																										
2.BALTEX		■	■					■			■		■	■				■					■		■	■	
3.CPPA			■	■					■	■	■	■	■	■						■	■						
4.LBA				■	■																						
5.LPB					■	■													■		■						
6.MAHASRI	■		■	■	■	■	■			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
7.MDB							■	■								■											
8.NEESPI								■	■		■							■									
9.Monsoon	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
10.Semi-arid	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
11.Cold										■	■																
12.High-elevation				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
13.WEBS												■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
14.Extreme												■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
15.Isotope																■	■	■	■	■	■	■	■	■	■	■	■
16.Aerosol																	■	■	■	■	■	■	■	■	■	■	■
17.GCM																		■	■	■	■	■	■	■	■	■	■
18.RCM														■				■	■	■	■	■	■	■	■	■	■
19.LSM																			■	■	■	■	■	■	■	■	■
20.HAP														■				■	■	■	■	■	■	■	■	■	■
21.In-site Data Archive																					■	■	■	■	■	■	■
22.Model Output Archive																							■	■	■	■	■
23.Satellite Data Archive																								■	■	■	■
24.Global Dataset Archive																									■	■	■
25.Distributed Integration																										■	■
26.Centralized Integration																											■

Figure C-4: CEOP Coordination/Assessment Overview Matrix

PART III - OUTLINE TASK PLAN FOR UPDATE/DEVELOPMENT OF CEOP IMPLEMENTATION/SCIENCE PLAN

It was decided at the meeting there was a need to specify the individuals currently working within the framework of the new CEOP. As a result Dr John Roads, Co-Chair of CEOP accepted the **action** to develop a CEOP “roster”. His preliminary listing is shown in Figure C-5:

	NAME	FUNCTION
Working Group Leads and	Toshiio Koike	CEOP co-chair (data integration)*
	John Roads	CEOP co-chair (hydroclimate science)*
* Drafting Team members	GEWEX RHPs	Hans Jorg Isemer*
	Jin Huang	CPPA
	Jose Marengo	LBA
	Hugo Berbery	LPB
	Hans-Jorg Isemer	BALTEX
	Amandou Gaye	AMMA
	Jun Matsumoto	MAHASRI
	Helen Cleugh	MDB
	Pasha Groisman	NEESPI
	Global Data Centers	
	Thomas Maurer	GRDC
	Tobias Fuch	GPCC
	Regional Foci	Congbin Fu*
	Congbin Fu	SAS
T. Ohata	CRS	
Jun Matsumoto,	Monsoons	
Tartare, Perotto	High Elevation	
Cross Cutting Studies	Ron Stewart*	
Kun Yang	WEBS	
Ron Stewart	Extremes	
?	Isotopes	
Bill Lau	Aerosols	
Models	Mike Bosilovich*	
Mike Bosilovich	Global	
Matt Rodell	GLDAS	
Burkhardt Rockel	ICTS	
Ray Arrit	SIEVE	
Hydrologic Applications	Eric Wood	
Eric Wood	HAP	
Data Management	Steve Williams*	
Steve Williams	Reference Sites/Basins	
Michael Lautenshager	Model Output	
?	Satellite Data	
Ken McDonald	CEOP Data Integration & Dissemination	
Toshihiro Nemoto	Central Data Integration	

Figure C-5: CEOP Preliminary “Roster” of Active Participants

It was decided that from the larger listing a smaller team of lead persons could be identified (see names in Figure C-5 identified by an “*”) to undertake to organize the community within their purview of responsibility and to obtain and unify inputs from that community that could become components of the new CEOP Implementation/Science Plan.

This new team was subsequently identified as the CEOP Team for Tracking and Integrating of Group Responsibilities (TIGR). An initial International conference call of the TIGR was subsequently organized and it was agreed at that time that the TIGR members would begin the process of updating the existing Coordinated Enhanced Observing Period Implementation/Science Plan and formatting the result into the new CEOP Implementation/Science Plan. This work is to proceed through a five step process using the CEOP Coordination/Assessment Overview Matrix shown in Figure C-4 above as the basis for this work. A graphic representation of the steps to be taken are identified on the matrix itself in Figure C-5.

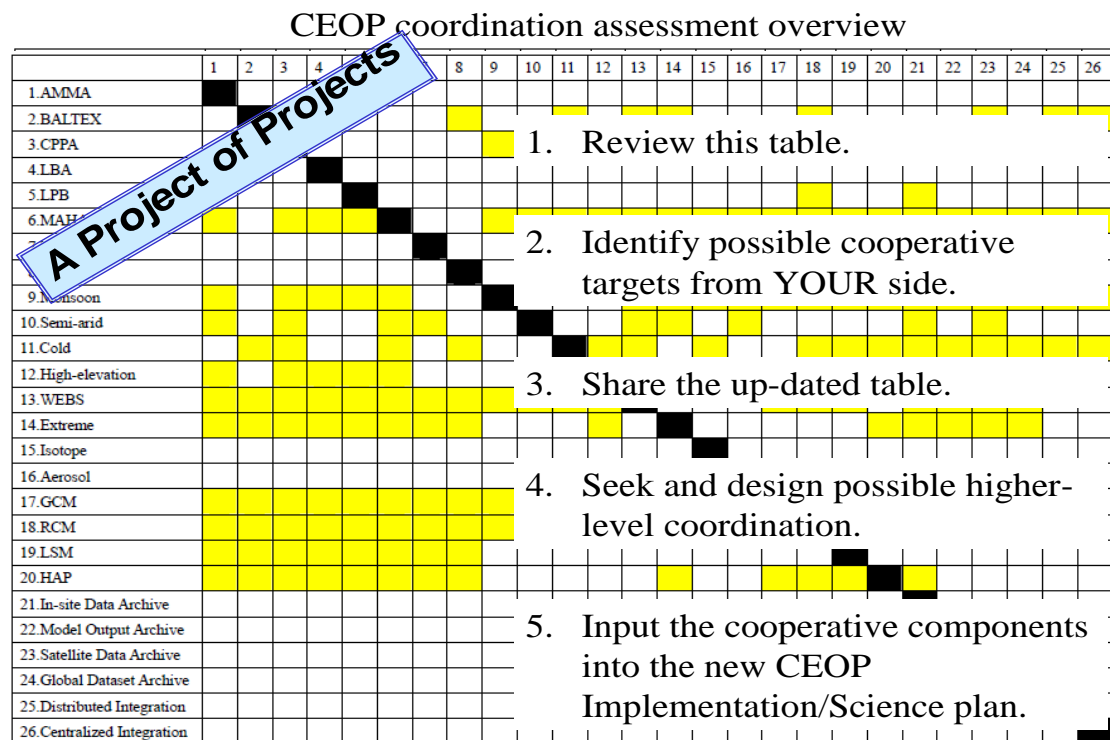


Figure C-5: Five step process for applying the CEOP Coordination/Assessment Overview Matrix toward the development of the new CEOP Implementation/Science Plan, by the CEOP TIGR.

It was subsequently decided that the CEOP TIGR would operate according to the following schedule:

- (i) a reporting template would be agreed upon by the end of March 2007;
- (ii) all inputs from each component obtained and consistently formatted by 30 April 2007;
- (iii) Second International TIGR conference call to be held on 1 May 2007;
- (iv) Group sections reviewed and updated internally by 15 May 2007;
- (v) Groups interchange sections for cooperative/coordinated review to be completed by 15 June 2007;
- (vi) Final review and formatting to be accomplished by 1 July 2007.

PART IV - CEOP CONTRIBUTIONS TO WCRP/GEWEX GOALS AND OBJECTIVES: THE GEWEX “ROADMAP”

As a separate exercise the participants and group leaders were asked to discuss and report, through a second round of breakout sessions, what the specific issues were that were associated with their concrete implementation strategies and related contributions that would be consistent with future WCRP/GEWEX plans as especially contained in the GEWEX “Roadmap”, that had been developed and distributed to all participants before the meeting.

The groups were again organized into the same four topic areas, namely, **Regional Hydroclimate Projects; Crosscutting Studies; Models; and Data.** The Chairs and Correspondents organized their groups to respond to what they will contribute for each year (2007–2012) to:

GEWEX Objective 1:

Produce consistent research quality data sets complete with error descriptions of the Earth's energy budget and water cycle and their variability and trends on interannual to decadal time scales, for use in climate system analysis and model development and evaluation.

GEWEX Objective 2:

Enhance the understanding of and quantify how energy and water cycle processes contribute to climate feedbacks.

GEWEX Objective 3:

Improve the predictive capability for key water and energy cycle variables and feedbacks through improved parameterizations to better represent hydrometeorological processes, and determine the geographical and seasonal characteristics of their predictability over land areas

GEWEX Objective 4:

Undertake joint activities with operational hydrometeorological services, related ESSP projects like the GWSP, and hydrological research programs to demonstrate the value of GEWEX research, data sets and tools for assessing the consequences of climate predictions and global change for water resources.

Regional Hydroclimate Projects Contributions to GEWEX Roadmap Breakout Session

This group was chaired by Drs Berbery and Huang. The outcome of their deliberations were distilled from inputs made by each of GEWEX RHP's. The results are summarized here:

GEWEX Objective 1:

“Produce consistent research quality data sets complete with error descriptions of the Earth's energy budget and water cycle and their variability and trends on interannual to decadal time scales, for use in climate system analysis and model development and evaluation.”

2007-2009:

Complete first regional analysis of the water and energy cycle with existing products

Diagnosis of causes of variations and trends of regional energy and water cycles (from weather to decadal scales)

2008-2010:

Promote regional observations as part of GCOS for the regional energy and water cycle studies

GEWEX Objective 2:

“Enhance the understanding of and quantify how energy and water cycle processes contribute to climate feedbacks.”

2008-2009:

Conduct field experiments to understand regional hydrometeorological processes (e.g., LPB, MAHASRI, CPPA)

2008-2010:

Develop information on floods and droughts for the specific RHPs and assessment of the role of land-atmosphere interactions.

2007-2010

Carry diagnostic and modeling studies of land surface-atmosphere interactions feedbacks

GEWEX Objective 3:

“Improve the predictive capability for key water and energy cycle variables and feedbacks through improved parameterizations to better represent hydrometeorological processes, and determine the geographical and seasonal characteristics of their predictability over land areas”

2008-2011:

Improvement of the applicability of the prediction models for key water energy and water cycle variables and feedbacks

Develop land surface datasets to be employed for validation and assimilation into regional and global models to improve their predictive skill.

GEWEX Objective 4:

“Undertake joint activities with operational hydrometeorological services, related ESSP projects like the GWSP, and hydrological research programs to demonstrate the value of GEWEX research, data sets and tools for assessing the consequences of climate predictions and global change for water resources.”

2010-2012:

Launch pilot projects in RHPs that will utilize hydrological ensemble prediction

Downscale and evaluate seasonal hindcasts over the RHPs

Assist the role of remote sensing to improve regional hydrological modeling

Contribute to assessing past, present and future hydroclimate variability and change and contribute to detection, attribution and vulnerability studies at the regional scales.

Establish collaborations with GWSP to develop assessments of availability of water resources based on climate projections for the 21st century

Evaluate the role of land cover/land use changes on the regional system's climate and hydrology

Crosscutting Studies Contributions to GEWEX Roadmap Breakout Session

This group was chaired by Dr Berbery. The outcome of the group's deliberations were distilled from inputs made by each of the CEOP Crosscut initiatives including: WEBS/WISE; Semi-arid region/Cold region/High elevation, but not SWING or Aerosols studies, which were not represented at the meeting. The results of these discussions are summarized here:

GEWEX Objective 1:

- Convergence of observation and data integration in cold regions (cold region)
- Derive long-term SWE and soil moisture by satellite (SSM/I) and/or ground based measurement (cold region).
- Develop long-term measurements of water, energy, aerosols in mountainous areas (high elevation)
- Develop high resolution datasets to create state-of-the-art precipitation forecasting (high elevation)
- Evaluate satellite products of precipitation and surface radiation and energy budget with reference data (WEBS)
- 2008: develop an inventory of floods and droughts and the role of land-atmosphere feedbacks in causing those events (WISE)



Planned milestones during 2007 to 2012 by SHARE (Stations at High Altitude for Research on the Environment) Project

Mountain/High Altitude Initiative (MHA)

- | | |
|------|--|
| 2007 | Improve Nepal and Pakistan AWSs in the direction of reference stations. New studies on atmospheric depositions, nitrogen cycle, and micropollutants in lake sediments records. Glaciers studies in Mt Everest region |
| 2008 | Glaciers studies and possibly hydrological studies in Mt Everest region. Improve Africa site on Ruwenzori with news and possibly in Buthan or Caucasus. |
| 2009 | Install a new ABC Complementary Station in Pakistan to study the aerosols and air composition. Paleolimnology in Africa site on Ruwenzori |
| 2010 | Enlarge the High Altitude Network |
| 2011 | Maintain High Altitude Networks |
| 2012 | ... |

Associazione "Comitato Ev-K2-CNR"

GEWEX Objective 2:

- Evaluate global water cycle using model intercomparison and parameterization sensitivity experiments (WEBS)
 - Land-surface, convective, and boundary layer schemes
 - Diurnal \diamond Interannual variability
- Identify and focus on regions where water cycle simulation has trouble (WEBS)
 - Overlap with semi-arid and cold region studies
 - Identify remotely-sensed datasets that will be useful
- Examine the vertical profiles of water cycle exchanges throughout column and their temporal variability (WEBS);
- 2008-2010: Regional hydroclimate hotspot studies in Tibet, including surface and atmospheric water and energy budget, its relation with extreme events in East Asia (WEBS)
- 2010: Provide an assessment of the role of land –atmosphere interactions during extremely wet and dry (drought) period (WISE);
- Understanding the water and energy cycles of semi-arid regions and their role in climate system by globally integrated analysis of CEOP reference sites data, satellite observations and model outputs (semi-arid);

- Impacts of dust aerosols on hydrological cycle and climate at regional and global scales (semi-arid; aerosols);
- Inter-comparison of cold region large rivers (Lena, Obi, Yenisey, Mackenzie), their temporal changes, and possible relation with regional warming (cold region);
- Glacial process studies (cold region; high elevation).

GEWEX Objective 3:

- 2007-2008: Apply CEOP-based inter-comparison study and identify model deficiencies in simulating diurnal, seasonal, and annual precipitation pattern and water and energy budget using CEOP phase 1 (WEBS);
- Evaluate LSMs' ability in semi-arid and cold regions and improve their performances (semi-arid; cold region);
- Improvement of parameterization of land surface process for semi-arid region to be coupled in climate models, with particularly a new scheme of eco-hydrological process (semi-arid);
- Apply current existed RCMs for semi-arid region simulation and identify their problems. Assist in better prediction of climate and water resources and their management in semi-arid regions where the shortage of water supply is crucial (semi-arid);
- High mountain hydrology including glaciers, interactions between vegetation and frozen ground and snow process (cold region);
- High resolution precipitation modelling in complex topography (high elevation).

GEWEX Objective 4:

- Assess the ability of models to simulate the impacts of heavy rain events and droughts on water resources (WISE)
- Provide high-resolution precipitation forecast for hydrological extreme studies (High elevation).
- Based on data inter-comparisons, recommend model and satellite data for hydro-meteorological applications (WEBS)

Models Contributions to GEWEX Roadmap Breakout Session

This group was chaired by Dr Bosilovich. The outcome of the group's deliberations were distilled from inputs made by each of the CEOP Modeling Groups including: Global, Regional, Land and Hydrological Applications (HAP). The results of these discussions are summarized here:

GEWEX Objective 1:

- 2007: Complete the quality control, production and distribution of the CEOP Phase I data sets. (CEOP)
 - [Documentation and verification of model data sets at the CEOP model data archive for global data \(atmosphere and land\)](#)
 - [cut-off date for delivering phase 1 model data to model archive](#)
 - [Documentation and verification of model data sets at the CEOP model data archive for regional model data from ICTS](#)
- 2007: 1980-2010 dataset: Request CEOP gather from NWP centers what their global reanalysis, land only global reanalysis, and re-forecast/hindcast plans are.
- 2008: Ensemble of CEOP Phase 1 monthly means and standard deviation (cross cutting to e.g. GRP radiation products)
- [Common Data Format](#)

GEWEX Objective 2:

- 2008: Develop an inventory of floods and droughts and the role of land-atmosphere feedbacks in causing those events. (CEOP, GRP)
 - Inventory how regional models simulate flood and drought characteristics using CEOP observations and ICTS simulations
- 2010: Provide an assessment of the role of land-atmosphere interactions during extremely wet and extremely dry (drought) periods. (CEOP)
 - Importance of specification and parameterization of vegetation in simulating wet and dry periods using CEOP observations and ICTS simulations.

GEWEX Objective 3:

- 2007: Start development of ground water parameterizations for regional to global scale models
- 2009: Promote the use of remotely-sensed data and develop related products to study the role of soil moisture in land atmosphere interactions. (GMPP, CEOP)
 - Implement data assimilation algorithms for soil moisture in uncoupled and coupled data assimilations systems
- 2012: Demonstrate the contribution of improved prediction systems for forecasting the onset and intensity of droughts and the recovery from drought. (CEOP)
 - NWP in CEOP will execute re-forecast experiments to demonstrate whether physical parameterization improvements that emerged from CEOP intercomparisons of GCMs with reference sites and satellite observations yielded improved predictions of hydrological significant events like droughts and floods and monsoons. (needs re-wording)

GEWEX Objective 4:

- 2007: Launch at least two pilot projects in GEWEX CSEs that will utilize hydrological ensemble prediction techniques as a HAP and HEPEX initiative. (CEOP)
 - CPPA launching a pilot project to demonstrate multi-model ensemble hydrological prediction (streamflow, snow pack, soil moisture) on medium range (1-2 weeks) and seasonal time scales.
- 2007: Downscale and evaluate seasonal hindcasts over the CSEs using NOAA and DEMETER seasonal forecasts that can be assessed by CSE scientists (CEOP)
 - Launch downscaling studies in CPPA seasonal hindcast experiment
- 2008: Develop links with THORPEX to undertake predictions on daily to monthly time scales to look at intra-seasonal prediction capabilities. (CEOP)
 - In CPPA pilot project launched in 2007 links are going to be created between CPPA and THORPEX for the inter-seasonal prediction range
- 2009: Evaluate seasonal hydrological forecasts from hindcast studies for the initial two pilot studies; and launch additional HAP and HEPEX pilot studies. (CEOP)
 - from the CPPA pilot project launched in 2007 (see above)

Data Contributions to GEWEX Roadmap Breakout Session

This group was chaired by Drs Williams and Toussaint. The outcome of the group's deliberations were distilled from inputs made by each of the CEOP Data Handling\ Groups including: NCAR, MPIM and UT. This group used a format which was based on milestones over the requested periods covered by the GEWEX objectives, namely 2007 and 2008 and beyond. This was considered to fit better with the plans for this activity within CEOP as a contribution to the GEWEX roadmap. The results of these discussions are summarized here in the group's selected format:

CEOP Milestones for 2007

1. Finalize reference sites, additional parameters (e.g. aerosol, clouds,...)
 - >> *Do you satisfy Phase-1 data archive ? If no, please provide us your requests.*
2. Finalize MOLTS points and formats
3. Finalize Model Output Data structures
4. Guidance on how to quantify and present error and uncertainty
 - >> *"uncertainty" in GEWEX objectives means such as data accuracy.*
5. Finalize phase1 archive

Milestones for 2008 and beyond

1. Establish linkages to other projects (e.g. BSRN, flux net) .
2. Investigate common data access or data converters to integrate data.

SUMMARY

It was concluded at the meeting that CEOP is making important progress towards the realization of its long-term guiding scientific goal: *"To understand and model the influence of continental hydroclimate processes on the predictability of global atmospheric circulation and changes in water resources, with a particular focus on the heat source and sink regions that drive and modify the climate system and anomalies."* By making progress toward this goal CEOP is responding to the challenges and priorities that relate to variations in the earth's water and energy budgets and the cycling rate of the hydrological cycle as posed by the International Panel on Climate Change (IPCC) and will contribute to the development of WCRP COPES and the GEO, GEOSS.

The Co-Chairs of CEOP with the CEOP Working Group Leaders and members and especially with the support of the CEOP Team for Integrating Group Responsibilities (TIGR); have the **action** to take the results and recommendations stemming from the deliberations by all the participants at the Sixth International CEOP Implementation Planning Meeting and integrate them into a coherent strategy for the Project to meet its goals and to formulate that strategy into a consistent format for publication as the CEOP Implementation/Science Plan by the time of the next CEOP meeting due to take place during the period 5-7 September 2007, at Bali, Indonesia.